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FOUR-CYLINDER INTERNALCOMBUSTION FOUR STROKE FLAT ENGINE WITH DOUBLE ACTION PISTONS.

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ABSTRACT: Engineering solution is related to four-cylinder internal combustion four stroke flat engine with double action pistons on common piston rod / 2+2 / with the straight – line motion transfer of pistons to the rotational motion by means of contra – rotating segment bearing to the central engine rotor and gear wheel with lean double gearing that is on output motor shaft. Mixture absorbtion and engine supercharging is solved with piston bottom at particular cylinder and their interconnection

KEY WORDS: engine, rotor, double-acting pistons

1. INTRODUCTION

With regard to four-stroke classical combustion engine is the straight-line motion transfer of pistons transferred to the rotational motion through piston rod to crank shaft. Disadvantage of these engines is the great amount of the movable parts that demand special precision and when the parameters are infringed engine performance show a loss, reduced fuel economy, decreased ecological parameters of the engine, various unwanted resonances, its weight, consumption of material and parameters. Other types of internal combustion engine e.g. with rotating pistons are expensive because of the material of high quality, precision and equivalent price, that decides about avalability of general public at auto market.

2. BASIS OF ENGINEERNG SOLUTION

Stated limitations are considerably eliminated with four-cylinder internal combustion four stroke flat engine with double action pistons straight – line motion transfer through contra – rotating friction segment bearing and common rod to central rotor with whose circuit lean double gearing is transmitted the torsion moment through gear wheel with lean double gearing to output motor shaft. The engine consist of fixed parts e.g. engine block, that is made of ordinary lite metals and moving parts also made of readily available materials.

As long as this engine does not have the standard crank shaft, all the straight-line motion is transmitted to engine rotor. Engine rotor fulfils a task of the flywheel. Output shaft is driven with gear wheel with lean double gearing, that has towards the rotor contradictory rotation speed.

The fact that these wheels are contrarotating and have mass forces and this way fulfil the task of flywheel positively influences fluent and balanced engine running and considerably eliminates undesirable effects [vibrations, noisiness]. Output driven shaft of engine front is used for the drive of the oil preasure pump that fulfil a task of bearing lubrication. Drive of gear-band-wheel, that drive cam shaft with cog belt [valve timing].

From output shaft are driven other machines necessary for running of the engine.[alternator, water pump, air conditioning, servo etc.]

With regard to the construction of this engine it is essential to use straight-line motion power of pistons motion in the enclosed cylinders on the common piston rod. The use of the space over piston of combustion chamber and under piston as the space for air absorbtion and release. This air absorbed under the piston is used for combustion chamber filling with the mixture. To achieve the sufficient amount of the air from so called under-piston to combustion chamber [because of the piston-rod volume deduction] is the problem solved the way, that four-cylinder engine has two and two cylinders that are diagonal and in paralel interconnected. With this interconnection is under-piston pressure of two and two cylinders added and that is exactly the effect of charging and supercharging of the engine with the mixture. The speed of this absorbed and also exhausted pressure exeeds classic turbocompressors or other systems of engine supercharging. Regulation of this air flow is controled with throttle valve that is placed in the common intake. The same way is working the four stroke engine. The amount of air is scanned by the air flow scanner, that is electronically interconnected with the control unit, that regulates where necessary the mixture ratio of particular engine regimes.

Advantages of four-cylinder internal combustion four stroke flat engine with double action pistons are:

- increase of engine efficiency [power output per liter]
- decrease of fuel consumption
- material saving
- decrease of gross engine weight and measurements
- reduction and decrease of friction areas of moving parts in engine
- noise reduction and fluent engine running
- engine supercharging without add-on devices [compressors, turbo…]
- easier production and maintenance
- decrease of emissions in exhaust fumes
- economic production expedience

Disadvantage is the exact determination of cylinder number – four at time in one section. [sixth cylinder is not possible]

3. OPERATING MODE OF THE ENGINE

Four-cylinder internal combustion four stroke flat engine [Fig.1.] works according to classic four stroke engine – four periods [absorption, compression, explosion, exhaust]

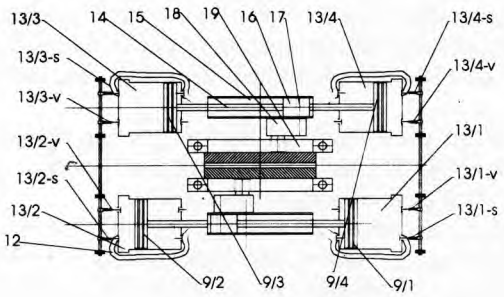

Fig.1: Combustion engine

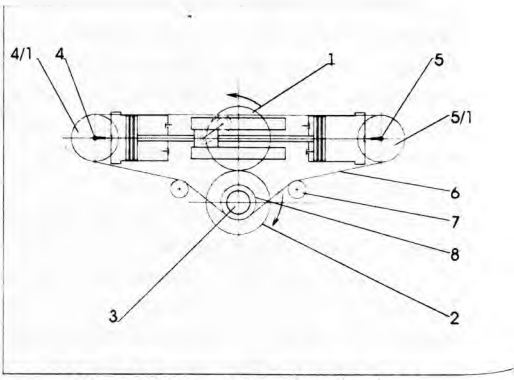

Fig.2: Front view – distributions

With regard to engine beside the system of straight-line motion transmission to rotor 1 and output shaft 3 are used also pistons 9 and cylinders from13.1to13.4.for intake trough pipe 11-s and supercharging through pipe 11-v. On the engine front [Fig.2] we can see the central rotor1 and gear wheel with double spiral gearing 2, that is directly on the output shaft 3. Wheel 2 transfers torsion moment on output shaft 3. On output shaft 3 there is gear band-wheel 8, that drives gear cam belt 6, that further drives cam shaft 4 and 5 with the help of driving wheel of cam shaft 4.1.and 5.1. Wheelwork displayed on the Fig.2 is valve distributions of engine. For engine to be able to make one operation cycle, the rotor engine 1 the gear wheel with double spiral gearing 2 must turn twice about 360 degrees i.e. two turns around self-axle. The engine and particular pistons from 9.1 to 9.4. explode every 180 degrees, i.e. four pistons from 9.1. to 9.4. in cylinders from 13.1 to 13.4 multiplied by 180 degrees, that are two mentioned turns of engine output shaft 3[Fig.6.]

3.1 Graphic combustion cycle

With regard to first 180 degrees the output shaft 3 turns right and rotor 1 left. The result of this is that piston 9/1 in cylinder13/1 absorbs the mixture the way [1 period], that presses up the air from under-piston 9/1 from the cylinder area13/1 where the piston rod ends 14 in intake chamber13.1.This air also presses up diagonally through piping 11-v interconnected piston 9.3. in the cylinder 13.3. The piston 9.3. supplies the cylinder 13.1 with air through piping because there comes to explosion and valves 13.3-s and 13.3-v are enclosed and this way help with charging of cylinder 13.1. with mixture. The same way mixture charging function also the cylinders 13.2 and 13.4 through interconnected piping 11-v.Ignition sequence of particular cylinder is also cylinder identification – cylinder 1,2,3,4, i.e.13/1, 13/2, 13/3, 13/4. To understand that precisely see pic.4.[22-vs] and pic.3 [21-vp] – direct-current valves that are placed inside engine cylinders always one by one in central under-piston admission 11-s and always one by one in exhaust pipe to combustion chamber 11-v, are automatic and similar to piston air compressor.

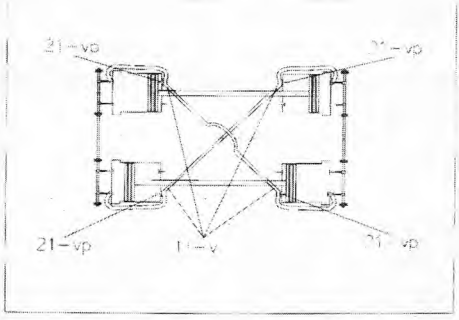

Fig.3: Pistons interconnection

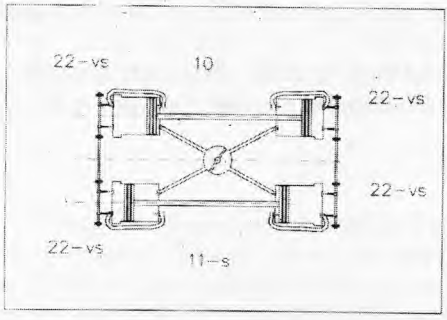

Fig.4: Valves motion

To specify the engine running [pic.6.] the following description of real engine running is attached:

- mixture admission 13.1 through piston running 9.1 in cylinder 1.period
- burnt gas exhaust 13.2. through piston running 9.2 in cylinder 4.period
- explosion 13.3 through piston running 9.3 in cylinder 3.period
- mixture compression 13.4 through piston running 9.4.in cylinder 2.period

This cycle changes according to assigned combustion sequence, that is in our case 1,2,3,4.

In the back view [Fig.5] there is image of flywheel 20 on output-shaft 3, that can be also frictional surface for dry clutch and placement of thrust plate of dry frictional clutch or other equipment.

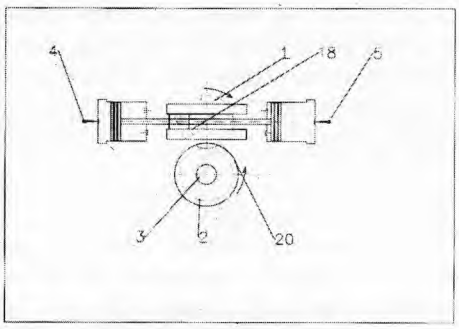

Fig.5: Back view – distributors

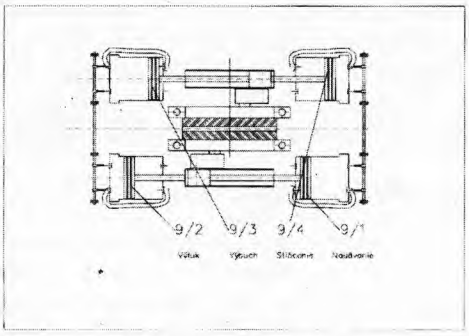

Fig.6: Engine running

4. CONCLUSION

Anticipated efficiency of this engine type is great. It can be used especially in automobile industry and as a unit of various industrial machines and machinery. Anticipated cubature is from 1000 to 12000 cubic centimetres. It is possible to use hybrid drive, that would serve as secondary generator of electric current, secondary engine and engine starter.

3. REFERENCES

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